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1991 ANNUAL REPORT

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

Alberta
AGRICULTURE

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Dr. Mohyuddin Mirza, Editor of the 1991 report.

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE
STAFF 1991

George Grainger	Director

ADMINISTRATION SECTION

Linda Hansen	Office Manager
Michele Dannish	Branch Secretary
Helen Rekrut	Shelterbelt and Administrative Secretary
Pat Fulton	Word Processor Operator
Sharon Peterson	Receptionist
Vicki Noël	Courier

Shelley Draper continued her secondment within the Division.

HORTICULTURE CROP DEVELOPMENT SECTION

James Letal	Section Head

Micropropagation Pathology

Dr. Piara Bains	Micropropagation Pathologist
May Yu	Pathology Technologist
Dr. Vikram Bisht	Lab Scientist
Dr. Zvezdana Pesic-Van Esbroeck	Lab Scientist

Several projects during the year were discontinued with the eventual reduction in the demand for labour, Dr. Zvezdana Pesic-Van Esbroeck left her position in December.

Horticulture Liaison

Betty Vladicka	Horticulture Extension Specialist
Pam North	Horticulture Information Officer
Don Geddes	Horticulture Information Officer
Jocelyn Young	Horticulture Information Officer

April 1, 1991 Betty Vladicka began a one year secondment with Market Development Division in the government's Accelerated Management for Women Program. She attended various training sessions to prepare her for the program prior to April 1. This provided an opportunity for Pam North to expand her experience in assuming most of Betty's duties. Jocelyn Young joined us April 1 to assist Pam during Betty's absence.

Vegetable Program

Belinda Choban	Vegetable Crop Extension Specialist
Dominique Bizon	Vegetable Technologist

Seed Potato Program

Jamie Motta	Seed Potato Production Technician

PROTECTED CROP DEVELOPMENT SECTION

Dr. Mohyuddin Mirza	Section Head

Tissue Culture

Kris Pruski	Tissue Culture Specialist
Tina Lewis	Lab Technologist

Sabina Pietucha left the Branch in February to pursue her career elsewhere, Tina Lewis assumed the duties as Lab Technologist.

Greenhouse Technology

Muhammad Younus	Lab Technologist

Greenhouse Pathology

Dr. Kan-Fa Chang	Lab Scientist

NURSERY CROP DEVELOPMENT SECTION

Brendan Casement	Section Head

Shelterbelt Production

Brian Breneman	Shelterbelt Production Specialist
Rulie Bok	Technician
Patricia Elliott	Gardener
Vera Fialkowski	Gardener

Arboretum and Research

Thean Pheh	Woody Plant Research Technologist
Henry Brown	Gardener

Container and Greenhouse Production

Cecilia McIsaac	Container Technologist
Sophie Eckberg	Gardener

Seed Investigation, Collection and Fruit Orchard

Simone Dalpe	Seed Technologist
Crystal Moore	Lab Technician
Nancy Moroz	Gardener

Chemical Application

Roy Marquardt	Chemical Application Technologist

FARM SERVICES SECTION

Al Faulkner	Section Supervisor

Farm Operations and Maintenance

Dave Wearmouth	Foreman
Kevin Thorpe	Gardener

Mechanical Maintenance

Brian Petherbridge	Mechanical Maintenance Chief
Stan Bootsma	Auto Mechanic
Gerhard Dames	Welder

Irrigation

Steve Milne	Technician

Paul Gervais will not be resuming his work at the Centre.

DIRECTOR'S REPORT

An encouraging year at the Centre with growth in most industry areas and valuable research results. The nuclear seed potato privatization continues and is on track to our five year goal. By 1994 all nuclear seed production will be in the hands of private growers.

Our advanced biotechnology work with Dr. A. Szalay at the University of Alberta has begun to show positive, encouraging results. New procedures for testing potato disease and micropropagation techniques have been developed. The causal agent of "Saskatoon Decline" has been identified after three years of observations.

Growth in the vegetable industry in north central Alberta levelled off in 1991. Crop specialization into crops such as baby carrots, baby potatoes, etc. helped maintain a viable industry. Many more of our vegetable trials were planted on co-operative grower fields.

The Master Gardener program continued a deliberate growth. Mrs. Betty Vladicka was seconded to a year long development project and Ms. Pam North was able to continue and lead the program into year two. It is hoped to have this program available to all rural Alberta by 1994.

Our strategic plan continues to provide the basic process for our direction and program development. As the industries continue to evolve and develop we have been able to alter our programs to ensure a leading role for most of our clients. Some rationalization of our programs is becoming increasingly important as needs in the industry change. It is our mandate to lead and provide the highest level of technology possible.

The greenhouse program has added the assistance to tree seedling growers. A group of growers under the Alberta Greenhouse Growers Association has been formed to advise us of their needs. Excellent co-operation has been provided by Alberta Forests, Lands and Wildlife as well as the growers in developing research projects. Nutrition of horticulture crops is becoming an increasingly demanding need and a solid base of information is being developed at this Centre on trees and shrubs, protected crops and woody fruit plants (sour cherries particularly).

The Canada/Alberta Soil Conservation Initiative continues to provide for increased awareness of the windbreak program and farmer demand has grown since its establishment. As evidenced by demand for plants as well as extension, Albertans are steadily becoming aware of conservation and the need to protect our soil and water resources.

The Centre has now provided an annual pruning course for 20 years and it continues to be a popular extension exercise.

In late 1991 Dr. Mohyuddin Mirza was named as an Adjunct Professor in Plant Sciences at the University of Alberta. Dr. Mirza will teach a greenhouse course. As well, co-operative projects are being developed with the University of Alberta Plant Sciences.

HORTICULTURE CROP DEVELOPMENT SECTION

The Horticulture Crop Development Section consists of the Seed Potato, Vegetable, Horticulture and Micropropagation Pathology Programs. The emphasis in this section has been to expand our research mandate and reduce production of seed potatoes.

Seed Potato Program - Jim Letal

The main emphasis of the Seed Potato Program this year has been to privatize production. In the past three years we have moved Pre-elite and Elite I seed potato production to the growers. As a result we were able to discontinue field production of these classes of seed potatoes. We have also moved toward privatizing greenhouse production of nuclear seed potatoes. We presently have five growers producing nuclear seed potatoes in greenhouses. Our plans are to continue to produce 50% of the nuclear seed potato needs until such time as the greenhouse growers gain experience and there is no risk of being short of nuclear seed potatoes.

The seed potato industry continued to expand. In 1990 production was up by 21% and seed potato export sales were up by 24% (see Table 1). Seed potato export sales by cultivar and state of destination are listed in Table 2. Oregon and Washington growers are still the main purchasers of Alberta seed potatoes.

Table 1. Alberta Seed Potato Production and Exports 1965-1991

CROP YEAR	NUMBER OF SEED GROWERS	SEED AREA (hectares)	PRODUCTION (tonnes)	EXPORTS (tonnes)
1965	59	1,033	16,773	265
1966	61	1,363	27,273	1,720
1967	53	1,220	19,636	145
1968	50	1,065	25,318	960
1969	42	1,165	17,591	1,992
1970	46	1,202	26,409	591
1971	45	1,216	18,091	185
1972	32	943	15,455	175
1973	26	672	13,091	1,530
1974	23	669	12,727	1,395
1975	24	620	12,000	2,200
1976	18	222	4,636	0
1977	16	512	6,909	78
1978	13	561	9,955	210
1979	14	466	10,455	414
1980	15	483	13,455	3,258
1981	19	593	13,273	3,630
1982	18	739	14,136	4,249
1983	23	971	21,818	6,228
1984	33	1,295	22,500	9,514
1985	37	1,675	30,310	10,488
1986	37	1,792	36,838	11,258
1987	35	1,619	45,000	14,289
1988	32	1,594	46,057	17,223
1989	32	1,932	48,303	19,539
1990	31	2,067	58,619	24,237
1991	32	2,155	56,390	------

Table 2. Seed Potato Export Shipments 1990-91 Crop Year

STATE	CULTIVAR	# OF SHIPMENTS	TONNES
CALIFORNIA	NORKOTAH	2	40.929
IDAHO	RUSSET BURBANK	12	246.215
	SHEPODY	105	2,150.978
			2,397.193
MONTANA	SHEPODY	1	2.503
OHIO	CONESTOGA	8	155.816
OREGON	ATLANTIC	24	484.560
	NORCHIP	6	123.891
	NORKOTAH	11	213.470
	NORLAND	2	39.400
	RUSSET BURBANK	135	2,755.682
	SHEPODY	50	1,008.511
	YUKON GOLD	1	10.102
			4,635.616
WASHINGTON	ATLANTIC	6	118.263
	CONESTOGA	2	39.253
	NORCHIP	12	281.313
	NORKOTAH	31	625.860
	RUSSET BURBANK	546	11,167.380
	SANGRE	2	42.071
	SHEPODY	220	4,503.705
	YUKON GOLD	6	117.383
			16,895.228
	TOTAL TONNES		24,237.285

Prepared by Agriculture Canada
September 1991

Table 3. Nuclear Seed Potato Production 1991

	No. of Tubers		No. of Tubers
A74117-9	40	Niska	1,200
Alpha	2,200	Norchip	8,500
Atlantic	2,500	Norgold Russet	250
Amisk	500	Norland	4,200
Banana	300	Novachip (F77087)	20
Batoche	30	Pink Pearl	100
Bintje	4,000	Purple Viking	80
Bliss Triumph	12	Purple 2126	20
Caribe	80	Ranger Russet (A7411-2)	230
Carlton	400	Red Pontiac	850
Columbia Russet	50	Rode Eersteling	300
Conestoga	2,600	Russet Burbank	16,000
Desiree	170	Russet Norkotah	4,000
Duke of York	50	Saginaw Gold	50
Estonia Red	30	Sangre	5,000
F76080	200	Shepody	14,000
Frontier Russet	9,500	Superior	800
Irish Cobbler	30	SV82142	120
Kennebec	350	SV83122	200
Matilda	120	Viking	800
McIntosh Black	30	Warba	300
Monona	2,500	W905	60
ND 398-1	60	Wisc 74-7	40
ND 1538-1	10	Yellow Finn	200
ND 671-6	15	Yukon Gold	530
		TOTAL	83,627

Seed potato tonnages are down by 3.8% primarily due to flooding in the Lacombe area and extremely dry conditions in the Edmonton area. In addition, in the Edmonton area the newly produced seed potatoes were sprouting in the field prior to harvest. This has affected the quality and storeability of this crop.

This year for the first time we had commitments for seed potato sales to Mexico. In January/February of this year Plant Industry and Market Development staff joined two seed potato growers on a mission to Mexico to investigate market potentials. In July we had a return mission from Mexico which resulted in their interest in Alberta seed potatoes. Edmonton Potato Growers negotiated the sale of 80 tonnes of Yukon Gold and 40 tonnes of Atlantic seed potatoes to one grower in Mexico. Unfortunately due to government red tape in Mexico the approval to ship these potatoes could not be obtained. As a result no seed potatoes were shipped to Mexico.

In the spring of 1991 we sold 65,505 nuclear and 47,650 Pre-elite seed potato tubers. In addition we sold 4,020 kilograms of Elite I seed. This year we produced 83,627 nuclear seed tubers in two crops, one planted in March and the second planted in July. Table 3 lists the cultivars and quantities of each cultivar that we produced. These nuclear tubers will be sold in the spring of 1992. We did not produce any Pre-elite or Elite I seed potatoes, these were produced by seed potato growers.

1991 was the year of PVY^n (Necrotic strain of Potato Virus Y). Eastern Canadian seed potato growers have been primarily affected. Although PVY^n has not been found in Alberta, we did have one grower who had a sister lot of a seed lot grown in Prince Edward Island that was misidentified as positive for PVY^n resulting in the destruction of his Sangre and Atlantic seed potatoes.

We continued with the Rhizoctonia/Fungicide trial. This trial is in the second year of evaluating seed-piece treatment fungicides for the control of the disease Rhizoctonia Stem Canker and Black Scurf (*Rhizoctonia solani*). Due to very dry growing conditions poor results were obtained in this trial.

Research on increased production of greenhouse nuclear tubers is continuing. Our objective with this research is to increase the number of tubers produced by greenhouse plants that originate from tissue cultures.

Micropropagation Pathology - Piara Bains

The focus of the program is to conduct research on diseases of important Alberta crops and provide disease-free nuclear mother potato plants for the Alberta seed potato program.

Research Staff: Piara Bains, Vikram Bisht, Jim Letal, Anatoli Melnikov, Jamie Motta, Zvezdana Pesic-Van Esbroeck, and May Yu.

Blackleg of Potato Caused By *Erwinia carotovora* Subspecies: Blackleg of potato is a disease of concern to Alberta potato growers. The objectives of the project this year were to 1) evaluate and correlate blackleg (stem rot) and tuber soft rot reactions of various potato cultivars, and 2) develop a rapid and reliable method for evaluating blackleg resistance. The results of the experiments conducted using five potato cultivars indicated no consistent trend in correlation between blackleg and softrot development of cultivars. Inconsistency could be due to inherent differences in softrot and stem rot resistance mechanisms.

There is no reliable technique for screening various cultivars or breeder's materials for blackleg resistance. An *in vitro* technique developed uses leaf petioles for symptom development. Freshly cut petioles were inserted in autoclaved sand drenched with bacterial suspension contained in a Magenta jar. The symptoms developed after three days of inoculations correlated well with various concentrations of the inoculum used. The technique is simple and efficient, and required no specific growing conditions for inoculated plant material.

Development of Transgenic Potato Plants Resistant to Blackleg: Very recently initiated a molecular genetics research program for the development of potato plants resistant to blackleg. Avirulent strains of *E. carotovora* generated by molecular cloning will be used to induce host defence response in different commercial cultivars of potato. Once the host defence genes are available they will be used to generate potato plants resistant to blackleg. Seven avirulent clones of *E. carotovora* were obtained by transforming *E. carotovora* with DNA from *E. herbicola*. However, rough size detrimentation of avirulent reaction causing plasmid indicated that it is quite large, approximately 50 kb. Efforts are being directed to obtain shorter plasmid. The project is in co-operation with Plant Molecular Genetics and Biotechnology Centre, University of Alberta.

A Low Cost and Simple Medium for Micropropagation of Potatoes: *In vitro* rapid multiplication of pathogen-free nuclear seed potato plants using tissue culture technique is being done in some grower established laboratories, and the indications are that the trend will continue. To reduce the cost of production and expand the program requires a low cost and simple tissue culture technique. Culture medium, an important but expensive and non-reusable component, is a prime candidate for cost reduction measures. A medium developed using V8 juice, table sugar, two greenhouse fertilizers, and agar or vermiculite

(V8 juice medium) was very inexpensive, simple to prepare and supported adequate root and shoot development of freshly cut nodal segments from *in vitro* grown mother plants. Performance evaluation of V8 juice medium plants in the greenhouse is the next step.

Release of Potato Dormancy: Dormancy of potatoes affects the seed potato industry by hindering seed potato export to subtropical markets, seed production from basic nuclear seed stock from greenhouses and rapid postharvest test procedures that require plants (Coleman *et al*, 1991).

Release of Potato Tuber Dormancy by Heat Treatment: Numerous chemicals are available for breaking dormancy of potato tubers, however, either they are toxic or not suitable for large scale application. Heat treatment of tubers was evaluated as a method for breaking potato tuber dormancy. Field grown Sangre tubers, one month after harvest, were used for the experiments. The treatments included incubation of tubers, for one, two and three weeks at 4°C, 21°C (room temperature), 32°C, 37°C, and 42°C, and Rindite treatment at room temperature. After the treatment the tubers were kept for sprouting at room temperature for two weeks. Sprouting of tubers was evaluated by observing number of tubers sprouted, position of sprouts on the tubers, and single or multiple sprouts from buds. Sprouting of tubers caused by three weeks of incubation at 37°C was similar to that caused by Rindite treatment and was best of all the other treatments. Tubers from three weeks at 21°C, three weeks at 37°C, and Rindite treatment were planted in the greenhouse. Six weeks after planting data were taken for number of stems per plant, height and fresh weight of plants. Plants from tubers treated for three weeks at 37°C produced much higher number of stems than the tubers kept at 21°C for three weeks, and were a close second to the Rindite treated tubers. However, similar heights and fresh weights of plants from tubers treated for 3 weeks at 37°C and Rindite treated tubers indicated that the former produced sturdier stems. Yield data were not taken due to greenhouse space constraints. The results suggested that heat treatment of tubers could become the basis of an effective and safer method for breaking tuber dormancy.

Saskatoon Decline: After about a year's efforts wooly elm aphid (*Eriosoma americanum*) was identified as the causal agent of "saskatoon decline". Aphid feeding on saskatoon roots caused formation of numerous root galls, reduced root size, and damaged secondary roots. It also caused reduced vigour and growth of plants, smaller and curled light green to yellow leaves and eventual necrosis of plants. Aphids were observed on two year old saskatoon seedlings, three and four year old saskatoon shrubs, and native saskatoons in shelterbelt. Furthermore, few growers have also reported the presence of aphids on roots of saskatoons of different cultivars and ages. Mr. Kris Pruski cooperated and was instrumental in the search and identification of the aphid.

Common Leaf Spot, Blight and Berry Spot of Saskatoon:

i. Source of primary inoculum: In 1990 growing season, saskatoon racemes were heavily infected with *Entomosporium mespili*, the causal organism of the disease. An experiment was conducted to determine the role of infected plant parts in overwintering of the fungus and as source of primary inoculum for next year. Microscopic examination of randomly selected twigs in spring 1991 showed no fungal structures, and fungus could not be isolated from these twigs. The results suggested that twigs may not be primary source of inoculum of *E. mespili*.

ii. Development of an *in vitro* method for disease resistance screening: Conidia of *E. mespili* in sterile water and Tween 20 were sprayed on leaves of two week old rootless saskatoon shoots grown in Magentas. After two weeks of incubation under continuous light, disease symptoms developed on the leaves, and microscopic examination of infected leaves showed the presence of acervuli with conidia.

iii. Liquid media for culture of *E. mespili*: The objective of the experiment was to obtain large amounts of inoculum of this very slow growing fungus. Potato dextrose broth (PDB) containing saskatoon leaf infusion gave maximum growth as indicated by dry weight of fungal colonies followed by PDB, PDB containing saskatoon berry infusion and basal medium.

Powdery Mildew of Saskatoon Caused by *Podosphaera clandestina*: This year's environmental conditions and location of our saskatoon variety trial were very favourable for the development of powdery mildew. Cultivars Parkhill and Success were found heavily infected early in the season. All berries harvested from Parkhill (by seed collection staff) were found to be infected with the fungus. Berries were wrinkled, shrivelled and covered with fungal mycelium, cleistothecia and conidia. An earlier report indicates that it is rare on berries. Observations taken later in the season showed that all plants of all cultivars were infected with the fungus.

Viruses of Alstroemeria: Tomato spotted wilt virus (TSWV) isolate obtained earlier from greenhouse-grown alstroemeria was further characterized to be TSWV-I (Impatience strain) by enzyme-linked immunosorbent assay.

Maintained a bank consisting of 64 cultivars/lines of nuclear mother potato plants. The plants were regularly tested for PVX, PVY, PVS and PLRV by ELISA, PSTV (potato spindle tuber viroid) by nucleic acid hybridization techniques, and bacterial infection by incubating plant segments in nutrient broth. In addition 90,000 greenhouse plants were tested for PVX, PVY and PVS by ELISA.

Scientific Publications

Journals:

Bains, P.S. 1991. Stem canker and black scurf of potato. Proceedings of the 19th Annual Meeting of the Prairie Potato Council, Edmonton, Alberta. Feb. 13-16, 1991. pp 60-65

Davidson, J.G.N., P. Bains, Z. Pesic-Van Esbroeck, and D. Kaminski. 1991. Epidemic of entomosporium berry and leaf spot of saskatoons throughout Alberta in 1990. Canadian Plant Disease Survey 71: 123-124

Pesic-Van Esbroeck, Z., P.S. Bains, and J.A. Motta. 1991. Survey for common leaf spot, blight and berry spot of saskatoon in central Alberta. Canadian Plant Disease Survey 71: 125

Abstracts:

Bains, P.S. 1991. A low cost and simple medium for micropropagation of potato. *In Vitro* 27:45A (Abstr.)

Bisht, V.S., P.S. Bains, and J.R. Letal. 1991. Correlation between blackleg and softrot development in potato. International Symposium on Advances in Potato Crop Protection. Wageningen, Netherlands, September 1-6, 1991. p 50 (Abstr.)

Pesic-Van Esbroeck, Z., P.S. Bains, and M.H. Chen. 1991. Double infection with tomato spotted wilt virus and a poty virus on greenhouse-grown alstroemerias in Alberta. Canadian Journal of Plant Pathology 13: 283 (Abstr.)

Vegetable Program - Belinda Choban

Industry

The fresh vegetable industry in north and central Alberta has increased modestly over the past several years, filling the needs of a niche market in Alberta. Over 300 growers direct marketed their fresh vegetables to Alberta consumers. Approximately 6% of these growers also marketed into the wholesale outlets, replacing imports on a seasonal basis. Vegetable production was excellent this year despite the spring set backs due to rain and snow. Most cole crops, other than broccoli, were transplanted into fields rather than direct seeded. This enabled better plant competition with weeds, resulting in better quality of marketable product. Adaption of improved transplant production techniques enabled growers to successfully field-set transplants as early as April 21. This led to earlier crop harvests (by approximately two weeks) and product being sold at premium prices. Crop specialization into baby potatoes, baby carrots, garlic and dried flowers increased considerably. Grower exposure to California production techniques has encouraged several growers to improve their product cooling techniques and experiment with nitrogen spraying on cole crops for weed control. Others have established excellent contacts for specialized equipment and supplies. Several market gardeners, after being exposed to specialized equipment, are now building their own mulch layers, bed shapers and vegetable washers.

Overall crop production was good and sales were excellent. However, low prices from out-of-province competition kept farm gate sales of wholesale marketing lower than expected. In addition, an early snow cover prevented the harvest of approximately 18% of the total harvestable crop acreage.

The vegetable program at the Alberta Tree Nursery and Horticulture Centre continued to provide a research and extension program to the fresh vegetable industry in north and central Alberta.

Extension

Extension activities focused on educating and transferring technology to growers in all aspects of vegetable field production.

This year's extension activities included 55 on-farm extension visits; over 2,000 one-to-one grower communications by telephone, fax or correspondence; 150 grower visits to the offices; and information transfer through courses, presentations, tours and a newsletter. Farm visits concentrated on grower needs, field diagnostic problems and beginner growers. Routine farm calls were kept to a minimum, therefore decreasing overall farm visits by 60%. Technology transfer was also provided through two research trial seminars, three production presentations at the Alberta Horticultural Congress, two grower presentations to northern producers at Fort Chipewyan and Fort Smith, one talk on crop diversification

to Alberta district agriculturists and two presentations to the Alberta industry about vegetable production techniques used in southern California. Assistance was also provided to a vegetable growers' field day/equipment demonstration/tour and to another growers' field day/barbecue. Ninety new grower inquiries were handled. Administration of grower use of specialized equipment and cooler use facilities continued.

Close liaison with the vegetable industry was maintained through contact with such organizations as the Alberta Special Crops and Horticultural Research Center in Brooks, the Alberta Fresh Vegetable Marketing Board, the Alberta Market Gardeners' Association, the Alberta Vegetable Advisory Committee, and the Fall Harvest Festival Committee (in consumer awareness promotion work). Liaison was further enhanced by regular visits to wholesale produce buyers and farmers' markets, and through regular contact with industry equipment dealers and supply companies.

Co-operation and assistance was provided to other government departments and agencies including Market Development, Engineering, ADC loan officers and Alberta Hail and Crop Insurance officers.

Research continued on cultivar evaluation and production technology, and was aimed to improve crop yields, product quality and crop earliness. Research was guided by industry demand and market information. Field trials were implemented by Dominique Bizon (the vegetable technologist) and two summer employees.

1. **Cultivar Evaluation - Edmonton**

   Cultivar evaluation on cole crops and sweet corn: 18 broccoli, 19 cauliflower and 29 sweet corn were evaluated for yields, quality and maturity. In addition, cole crops were evaluated for cold soil germination, transplant versus direct seed production, transplant tolerance to frost and succession seeding. Broccoli was also evaluated for shelf life; and cabbage for four months and six months storage potential (with co-operation from Paul Ragan, ASCHRC, Brooks). In addition a broccoflower cultivar evaluation was done. Broccolflower is a new and increasingly popular direct marketing vegetable that looks like a cross between broccoli and cauliflower, usually green or purple in colour.

2. **Cultivar Evaluation - Peace River**

   With grower co-operation, the Peace River cultivar evaluation trial continued. Forty-four cabbage and 23 sweet corn were evaluated for yields, quality and maturity.

3. Chinese Vegetable Co-operative Trial

A co-operative trial with the greenhouse program in Chinese vegetable production was done. Joi choi and Bok choi were grown under various temperatures and evaluated for bolting potentials.

4. Cabbage Herbicide Trial

A herbicide trial for weed control in direct seeded cabbage was done on contract and with grower co-operation. Four herbicides were used to control annual broadleaf weeds, mainly chickweed. Preplant treatments, two-leaf spray treatments and four-leaf spray treatments were used. Trial work is scheduled for continuation next year.

5. Broccoli Fertility Trial - Farm Demonstration

A broccoli fertility farm demonstration trial was done with grower co-operation. Three application rates of combined nitrogen and phosphorus were applied to a broccoli production field. Data collection was incomplete. More testing is scheduled for next year.

6. Potato Prairie Regional Trial

The Edmonton site for the Potato Prairie Regional Trial continued. This was done in co-operation with the potato program from ASCHRC, Brooks and under the direction and administration from Canada Agriculture Research Centre in Lethbridge.

Publications

ATN&HC pamphlet - #91-V02 "Vegetable Cultivar Trials"

Horticulture Extension - Pam North

This program provides horticultural information to the general public. It is our opinion that a well informed consumer will facilitate the development of the horticultural industry through the purchase and proper use of plants and products.

Horticulture extension staff includes Betty Vladicka who was on a one year secondment with Alberta Agriculture, Market Development that began on March 21, 1991. In her absence, Pam North handled many of her duties. Don Geddes, a wage employee was on staff until October 11, 1991. Jocelyn Young, also on wages, was hired from April 1, 1991 to March 31, 1992.

The most significant change to horticulture extension this year was the implementation of the Master Gardener (MG) program. The ten participants in the pilot project completed 50 hours of training in March. The topics for the training sessions included plant and soil science, culture of specific horticultural crops; disease, insect and weed control and pesticides. After training, the Master Gardeners were expected to volunteer 50 hours of service to horticulture extension. The volunteer commitment was fulfilled by answering horticultural inquiries over the telephone from the general public. Approximately 530 hours of service were provided between April and September with the volunteers handling 1928 calls.

An Advanced Master Gardener program will proceed early in 1992 with graduates from the pilot project. They will receive 25 hours of training on specific horticultural topics and are required to volunteer 25 hours of service.

Volunteers for the fall training session were recruited by advertising through posters and brochures in local garden centres. Interviews were conducted and eleven participants were accepted into the program. Orientation was at the end of October and the first training session was held in November.

Although the Master Gardeners assisted with telephone inquiries, horticulture extension staff continue to handle the majority of calls (see Table 1). The number of calls increased by 1104 or 18% over 1990. There was also a 23% increase in the number of calls through the "hortline". This service provides taped messages on timely horticultural topics that are changed twice per week.

There was also an increase in demand for our basic plant diagnostic service. Eighty-two more plant samples were processed this year than in 1990.

The number of soil test reports handled by horticulture extension staff also increased in 1991. Recommendations for vegetable gardens and trees have been computerized to reduce the time involved in soil report preparation.

Regional horticulture courses were offered through the district offices of Field Services. Thirteen courses were delivered between January and April. Farmstead Planning and Tree Care were the two courses most frequently requested. In addition, fourteen presentations were delivered to a variety of organizations including service clubs, agricultural societies and Farm Women's Conferences.

A one day turfgrass seminar was organized by horticulture extension. Dennis McKernan, from Olds College was the guest lecturer.

Horticulture extension maintained frequent contact with the media to disseminate horticultural information to a wide audience. Forty-two interviews were taped for Call of the Land which is carried by 15 radio stations throughout the province. Twenty-two additional interviews were provided to various radio stations as well as six appearances on CBC's openline radio show, Wild Rose Forum. Written information on timely horticultural topics was provided on a regular basis to the Edmonton Journal and Agri-News.

Coordination of the Alberta Horticultural Association education program continued. Assistance with administrative duties was provided to this association when requested.

The Municipal Grant Program was terminated. If some municipalities are unable to provide horticultural information in the future, this may place an increased demand on our service.

Betty Vladicka enjoyed her secondment with Market Development. During this time she continued to assist the Friends of the Devonian Botanic Garden.

Table 1. Horticulture Extension: Statistics for 1991

	Telephone Inquiries	Hortline Calls	Soil Reports	Office Visits	Plant Samples	Publications
January	135	121	31	---	---	715
February	180	110	2	2	4	620
March	196	137	13	1	2	2,968
April	643 (staff) 121 (MGs)	533	24	5	10	37,025
May	675 (staff) 583 (MGs)	657	82	26	37	6,160
June	785 (staff) 331 (MGs)	376	21	35	63	1,449
July	737 (staff) 553 (MGs)	371	36	25	66	4,866
August	654 (staff) 171 (MGs)	328	35	24	73	1,046
September	652 (staff) 169 (MGs)	256	33	11	17	516
October	335	227	8	6	29	1,194
November	126	116	47	---	1	162
December	78	60	9	---	---	122
Total	7,124 5,196 (staff) 1,928 (MGs)	3,292	341	135	302	56,724

PROTECTED CROPS DEVELOPMENT SECTION

Greenhouse Program - Commodity Report - Mohyuddin Mirza

Nineteen ninety-one was another good year for the Alberta greenhouse growers, in spite of a generally slow economy. The growers improved the greenhouse structures and added new equipment through the Alberta Greenhouse Industry Assistance Program. This improved the greenhouse environment, resulting in better quality and higher yields.

The vegetable sector expanded in the areas of tomato production. One grower in central Alberta reported yields of 59 kg/m^2 from a 900 m^2 greenhouse facility, which may be the highest production in the world. This grower has utilized assistance and research information developed at the Alberta Tree Nursery and Horticulture Centre, Edmonton.

Seedless cucumber growers had problems with powdery mildew that caused some yield reduction. Growers switched over to powdery mildew tolerant varieties and are using potassium silicate on a regular basis.

The indoor spinach and lettuce facility in Spruce Grove continued to produce excellent quality plants. Root browning problems were investigated on a regular basis. Sun Country Foods established a good example of manpower sharing with the Alberta Tree Nursery and Horticulture Centre to get some research done.

Bedding and ornamental plant growers had a good year. A cost of production survey was completed for them by Mr. N.G. Chaudhary of the Production Economics Branch of Alberta Agriculture.

Cut flower sector did not expand in 1991. Imports from Mexico increased and this was a concern for the growers.

The tree seedling sector expanded slightly. New beginner contracts were given out. The tree seedling group got more organized under the Alberta Greenhouse Growers Association.

The Alberta Greenhouse Growers Association continued to progress well and the Alberta Horticultural Congress in Red Deer was a great success.

Alberta Agriculture continued to provide extensive diagnostic and research backup to the greenhouse growers.

The Soils and Animal Nutrition Laboratory continued to provide soil and water analyses on a priority basis, although the trend was to use private laboratories.

Greenhouse Extension Program

The 1990-91 season was very busy for greenhouse extension and technology transfer. The contact with the tree seedling growers increased considerably and so did their demand for more information. Following are some of the specific details:

1. Diagnostics and trouble shooting was provided on the basis of need and demand. A large number of growers asked for input. In order to serve the tree seedling growers better, a survey was conducted to determine nutrient status of seedlings throughout the year. A student was hired to visit growers, collect samples, fax the data back to the growers and provide other help as needed. Ten thousand dollars was spent on this project. Data was also generated on total carbohydrates in tree needles and will be used to predict the health of the plants. Six thousand dollars was committed by the Commercial Tree Section, Pine Ridge Nursery at Smoky Lake.

2. Nutrient tests of water, soil, hydroponic solution and other growing media were carried out and recommendations made to the growers.

3. Specific help was provided to Sun Country Foods of Spruce Grove. This is a successful indoor production facility for spinach and lettuce. The problem of root browning and growth stunting was investigated.

4. Input was provided into greenhouse production economics surveys. Bedding plants survey cost of production was completed but it has not yet been released by the Production Economics Branch.

5. Alberta Greenhouse Notes continued to be a major tool for information transfer to growers within the province and outside the province. The format has undergone a change as well.

6. Greenhouse information was provided to about 100 would be growers. Several tours were conducted at the site. Many Indian bands showed interest in greenhousing.

7. Evaluated projects for funding by the Alberta Agricultural Development Corporation.

8. Taught a greenhouse course at the University of Alberta.

9. Conducted courses and workshops:
   Tree Seedlings course at ATN&HC
   Bedding Plants course at Olds college
   Hydroponics course at ATN&HC.

10. Participated in the activities of Alberta Greenhouse Growers Association by being appointed on the Board of Directors.

11. Participated as a guest speaker in the Alberta Horticultural Congress and Saskatchewan Greenhouse Growers Association.

12. Assisted the Commercial Tree Section, Pine Ridge Nursery, Smoky Lake in their fertilizer programs for the tree seedlings.

13. Acted as a committee member for the administration of the Alberta Greenhouse Industry Assistance Program.

Greenhouse Crops Research - Muhammed Younus and Mohyuddin Mirza

Effect of Different Seeding Dates on the Development of White Spruce Tree Seedlings

To evaluate different seeding times and their effect on the tree seedling development, white spruce were seeded in peatlite mix on three different dates - February 13, March 12 and May 6, 1991. Two different cavity sizes were also evaluated, Ventblock® cavity size 160 (65 ml) and 112 (106 ml). The blocks were kept covered with clear polyethylene until 80% of the emergence. The seedlings were thinned out to a single plant per cavity after two weeks of emergence. Fertilizer applied was 10-52-10 1 g/L once a week for the first two weeks after three weeks of seed emergence. Later on the seedlings were regularly fertigated with 13-0-46 0.75 g/L, 15.5-0-0 0.5 g/L, 0-53-34 0.3 g/L, magnesium sulphate 0.5 g/L and chelated micronutrients of boron 0.3, copper 0.12, iron 3.0, manganese 0.8, molybdenum 0.1 and zinc at 0.12 ppm.

The bud set was achieved by withholding nitrogen after the height was around 13 cm.

Comparison of stem caliper and height on all three dates and both cavity sizes were made.

Table 1 represents averages as of November 15, 1991.

Table 1.

Seeding Dates	February 13, 1991		March 12, 1991		May 6, 1991	
	C mm	H mm	C mm	H mm	C mm	H mm
Cavity Size 160	3.05	179	2.49	136	1.64	125
Cavity Size 112	3.24	185	2.76	148	2.09	142

A regular E.C. and pH monitoring of the nutrient solution and leachate was also conducted.

Plants seeded on February 13 and March 12 were of good quality, meeting the requirements of height and caliper. May seeding was of interest to bedding plant growers, because of feasibility of seeding after bedding plants are transferred outside the greenhouse. The difficulty was that plants would enter dormancy before gaining proper height and caliper.

Effect of Gro-mate on the Yield of Greenhouse Tomatoes Grown in Perlite

Greenhouse tomato cv. Caruso was seeded on December 4 in 10 cm rockwool cubes and germinated at 22°C day and night temperature. The young seedlings were grown under high pressure sodium lights in a greenhouse with a temperature regime of 20/20°C day and night. A regular fertilizer schedule was followed as given in the Greenhouse Vegetable Production Guide for Alberta Growers (Agdex 250/15-1, 1990-1991).

The seedlings were planted in 20 L plastic containers on February 18 with perlite as a growing medium. The experimental design was a randomized complete block with three replicates for each treatment. A drip irrigation system was set up to deliver fertilizer solution to each plant. The solution volume was adjusted to accomplish 15-20% leaching so that the electrical conductivity was maintained around 2.0 ms/cm.

Gro-mate liquid, containing 15% humic acid and 25% fulvic acid was manually supplied to the plants on a weekly basis at rates of 100, 150, 200, 250 and 300 ppm.

Blossom end rot was controlled by using regular foliar sprays of calcium chloride at 1 g/L.

Night temperature was maintained between 18-21°C while day temperature fluctuated between 26 and 40°C. Carbon dioxide was maintained at 1000 ppm during the first two hours of sunlight.

Harvest began on April 8 and was completed on July 18. The fruit was produced on a single stem.

Plants from control produced 9.27 kg of fruit/m^2 while plants receiving 250 ppm produced 9.42 kg/m^2. The differences were not significant at 1% level when analysis was done with Duncan's Multiple Range Test.

Tomatoes harvested from plants receiving 250 ppm of Gro-mate ripened one week earlier than control and this trend was like the previous one observed in plants grown in peat based media getting Gro-mate as an amendment.

Comparative Yields of Four Cultivars of Seedless Cucumbers Grown on Rockwool

Cultivars Flamingo, Jessica, Sortena and PSR 63585 were seeded on February 8 in 10 cm rockwool blocks and germinated at 25°C in a greenhouse. They were transplanted on February 26 into rockwool slabs at a spacing of 1.42 plants/m^2. Fertilizer and other management practices followed were according to the Greenhouse Vegetable Production Guide for Commercial Growers (AGDEX 250/15-1).

Harvest started March 25 and the crop was removed on May 8.

The data on yield is given in Table 2.

Table 2.

Cultivar	kg/m^2	Fruit length (cm)
PSR 63585 (Peto Seed)	21.14	36.7
Flamingo (Leen De Mos)	15.52	33.6
Jessica (Rijk Zawan)	17.14	34.4
Sortena (De Ruiter)	17.28	33.5

CV PSR 63585 yielded better than three other cultivars. Flamingo is a powdery mildew tolerant cultivar and it showed leaf deformity which is commonly associated with such cultivars.

Effect of Different Growing Media on the Yield of Seedless Cucumbers

The objective of this trial was to compare four different growing media as to their effect on the yield of seedless cucumbers and observe management problems which might develop for commercial growers.

Cultivars Flamingo, PSR 63585, Jessica and Sortena were seeded on May 14, in 2 cm rockwool plugs and germinated in a growth chamber. They were transferred into 10 cm rockwool cubes two weeks after germination. Three week old seedlings were then transferred into 30 L plastic pots with a standard soilless medium, or perlite or sawdust or rockwool slabs. The plants were set up in a complete block design with three replicates. There were 1.48 plants/m^2 of greenhouse area.

A drip irrigation system was used to deliver nutrients to the plants based on a timing device. Not all growing media could be delivered the same amount of water due to design difficulties.

The crop management practices were as outlined in the Greenhouse Vegetable Production Guide for Commercial Growers (AGDEX 250/15-1).

The data was recorded on the total marketable yields.

The data is given in Table 3.

Table 3.

Growing Medium	Marketable Yield (kg/m^2)
Soilless	26.9
Rockwool	18.1
Perlite	19.4
Sawdust	18.1

The yields from plants grown on soilless medium were significantly higher when compared to those plants grown on rockwool, perlite and sawdust. This was due to the fact that soilless medium had excellent water holding capacity. While other media will dry out, especially over the weekend, the soilless medium retained good moisture. This inadequate amount of water delivered to rockwool, perlite and sawdust resulted in lower yields. These media have excellent porosities but little water holding capacities.

Monitoring of Thrips Population in Greenhouse Cucumber Crop

The present study was conducted to evaluate thrips population in the greenhouse during the whole cucumber crop.

Yellow sticky traps were installed at 20 m^2 throughout the greenhouse. The study started June 1, when thrips population was at zero level. The number of thrips were calculated on the basis of a 100 cm^2 area.

Biological control agent, thrips predator (*Amblyseius cucumeris)* were released for four consecutive weeks from July 10 to July 31, and later a single release was made on August 14. The crop was pulled out August 26 and the final thrips population count was made.

First thrips were recorded June 17 on only three cards and there were only two to three thrips per card. The thrips population ranged from 3 - 23 per 100 cm^2 on June 24, 26 - 98, 13 - 203 on July 2 and 8 respectively.

At the end, on August 19, it had again risen to 116 - 186 per 100 cm^2. Thrips population was at its highest level of 509 - 1653 per 100 cm^2 at the time of crop removal. The last count made before the applications of Dibrom was 360 - 2031 per 100 cm^2.

On September 3 greenhouses were sprayed with Dibrom. The temperature was raised from 20 to 40°C for a period of two days. New cards were installed on September 5 and temperature was decreased to 20°C. Thrips monitoring was continued until September 19, when the population again reached a zero level. A new cucumber crop was brought in on September 27 and until November 15, the thrips population was at zero level.

Our results indicate a significant reduction and control in thrips population achieved with the help of biological control agent *A. cucumeris*. Later on when the thrips populations were at its highest level, a single application of Dibrom helped to bring the thrips population to a zero level. The thrips population has been kept at this level without any further application of any biological and chemical means.

Effect of Gro-mate on the Rooting and Growth of Poinsettia

The objective of this study was to evaluate the efficacy of Gro-mate on the rooting and growth of poinsettia.

Gro-mate is a product containing humic and fulvic acid, marketed by Humate® Canada Ltd. of Calgary. The experimental material was supplied by the above company.

The cultivar Anette Hegg Red poinsettia plugs were transplanted in 10 cm Azalea pots containing a standard soilless mix and placed in a mist chamber with bottom heat. High phosphorus feed was used for the first three weeks of plant establishment. Plants were removed from the chamber after three weeks and placed in a glass greenhouse. One hundred and twenty plants were divided into five treatments in a completely randomized block design. The fertilizer program consisted of 20-10-20, 0.5 g/L, 15.5-0-0, 0.5 g/L, magnesium sulfate 0.5 g/L and molybdenum at 0.1 ppm on a regular basis.

Four different levels of liquid Gro-mate at 100, 200, 300 and 500 ppm were supplied at a rate of 250 ml/plant on a regular basis. Control plants were watered with fertilizer only.

The rooting was rated on a scale of one to five, five being a root system fully developed on the outside of the growing mix.

An application of 200 ppm of Gro-mate resulted in the best rooting and the plants were rated as five as compared to a rating of three for the control and 100, 300 and 500 ppm of Gro-mate.

The effect of Gro-mate on rooting was evident in the first two weeks of establishment period and resulted in a better quality plant when assessed on a visual basis.

Effect of Different Liming Materials on the pH of Peat Moss

The objective of this study was to examine different sources of peat moss for pH and the effect of different liming materials on pH rise. Eight samples were gathered from local firms and pH readings were taken on a 1:2 slurry. Dolomite lime was added at rates of 5, 10, 15 and 20 g/L of peat moss. Potassium bicarbonate was also added at 1, 2, and 3 g/L of peat moss. Potassium bicarbonate was also added at the same rates along with dolomite lime at 20 g/L of peat moss.

pH readings were taken immediately after mixing of liming materials and after three weeks of staying in solution. The readings represent an average of five replicates.

A chemical analysis was carried out on water extractable nutrients after three weeks.

The data on pH readings is summarized in Table 4.

pH values in peat moss collected from different sources ranged from 3.8 to 5.57. Consequently different rates of dolomite lime influenced the pH based on the starting values. Dolomite lime completed its action in about three weeks time. Potassium bicarbonate was reactive immediately after mixing and the pH values did not change much over a three week period. Mixing potassium bicarbonate with 20 g of dolomite lime per litre of peat moss also showed an immediate rise in pH.

Calcium and magnesium contributions from dolomite lime after three weeks was minimal. Three grams of potassium bicarbonate contributed 170 ppm of available potassium.

This information will be useful for commercial greenhouse crop growers to design a better growing mix.

Table 4. pH Changes in Peat Moss Over a Period of Three Weeks

Dolomite Lime	Alberta Rose I		Alberta Rose II		Lakeland I		Lakeland II		North Star I		Northstar II		Sunshine I		Sunshine II	
0 g	5.57	5.55*	4.3	4.3*	3.8	3.8*	5.4	5.4*	4.0	4.0*	5.2	5.2*	3.8	3.9*	4.6	4.6*
5 g	5.65	6.28	4.5	5.4	3.9	4.9	5.5	6.3	4.2	5.3	5.4	6.1	4.2	5.1	4.7	5.8
10 g	5.75	6.93	4.7	5.9	4.0	5.3	5.6	6.5	4.2	5.5	5.5	6.4	4.4	5.6	4.8	5.9
15 g	5.82	7.06	4.7	5.9	4.1	5.4	5.6	6.8	4.5	5.9	5.6	7.0	4.2	5.6	4.9	6.0
20 g	5.88	6.76	4.7	5.6	4.1	6.0	5.7	6.6	4.6	5.5	5.7	6.6	4.6	5.5	4.9	5.9
20 g lime + 1 g Pot. bic.	6.43	6.68	4.9	5.2	5.8	6.0	5.7	5.9	5.7	5.9	6.2	6.5	5.9	6.2	5.7	6.0
2 g Pot. bic.	6.52	6.83	6.2	6.5	6.1	6.4	6.5	6.8	5.9	6.2	6.4	6.6	5.7	6.1	5.9	6.2
3 g Pot. bic.	6.80	6.93	6.5	6.6	5.8	5.9	6.3	6.5	6.5	6.7	6.7	6.8	6.4	6.5	5.8	6.0
1 g Pot. bic.	5.91	5.98	5.3	5.4	4.6	4.8	5.8	5.9	4.7	4.9	5.7	5.9	4.4	4.6	5.5	5.7
2 g Pot. bic.	6.20	6.32	5.9	6.0	4.9	5.1	6.3	6.4	5.1	5.5	6.0	6.2	4.9	5.1	5.6	5.7
3 g Pot. bic.	6.50	6.70	5.6	5.8	5.8	6.0	6.2	6.4	5.5	5.7	6.3	6.5	5.5	5.7	6.6	6.8

* Reading after three weeks Pot. bic. = potassium bicarbonate

Effect of Different Additives on the Porosity and Other Characteristics of Growing Mixes

An experiment was carried out to determine percent porosity, water holding capacity (WHC), cation exchange capacity (CEC) and exchangeable calcium on different growing mixes. The objective was to design a suitable mix for tree seedling growers, who use small volume containers.

Percentage porosity and water holding capacity was determined by calculating the amount of water needed to wet the medium; the total volume of the growing mix and the volume of the drained water. Cation exchange capacities were determined by Soils and Animal Nutrition Laboratory using standard procedures.

The data is presented in Table 5.

Styrolite, an inert material from styrofoam was added to peat moss, increased its porosity and decreased water holding capacity. Cation exchange capacity and exchangeable calcium decreased. Perlite addition to peat moss behaved similar to styrolite but the changes in percent porosity and water holding capacity were less pronounced.

Vermiculite improved cation exchange capacity and exchangeable calcium. Peat, perlite and vermiculite at 2:1:1 ratio gave a porosity of 16.6%, water holding capacity 43.4% and cation exchange capacity of 140.8.

This experiment helped tree seedling growers select a suitable mix.

Table 5. Effect of Different Additives on the Porosity and Other Characteristics of Growing Mixes

Growing Mix	% Porosity	% Water Holding Capacity	Cation Exchange Capacity meq/100g	Calcium Exchange Capacity meq/100g
Peat Moss	9.28	60.72	131.6	68.0
Peat Moss + Styrolite				
3:1	24.28	45.70	100.4	52.8
2:2	32.14	37.80	69.2	35.6
1:3	35.83	24.10	48.8	20.5
Peat Moss + Perlite				
3:1	14.28	55.70	138.8	84.8
2:2	15.00	45.00	83.6	52.8
1:3	20.00	40.00	56.4	33.2
Peat Moss + Vermiculite				
3:1	8.33	51.67	184.4	115.6
2:2	12.50	47.50	201.6	130.0
1:3	18.33	41.60	226.8	146.0
Peat Moss + Perlite + Vermiculite	16.66	43.40	140.8	83.2

Extractability of Copper in Peat Based Media

Tree seedling growers experienced copper deficiency symptoms in spruce during rapid growth phase, although 0.2 ppm of copper was being supplied through the nutrient solutions. In order to find out how much copper was being tied up by organic matter, an experiment was carried out.

Copper chelate or copper sulfate w: added to a commercial soilless mix in amounts varying from 1.0 to 10.0 mg/L. The growing mix was thoroughly soaked, then air dried and the amount of copper extract was determined on a water extract. The analyses were carried on the ICP machine by the Soils and Animal Nutrition Laboratory.

In the case of copper chelate the recovery rate varied between 2 and 7% while in the case of copper sulfate the variation was between 1 and 1.6%.

This means that in the case of copper chelate, more copper was available for plant use when compared to copper sulfate. Based on this experiment, the recommendations to commercial growers were changed.

Evaluation of Salvia as a Flowering Potted Plant

To evaluate the logistics for the production of salvia as a potted plant, Salvia (*Salvia splendens*) plants were grown from seeds. It is fairly easy to produce plants of excellent quality. Since they are resistant to fluoride injury, a common problem with most potted flowering plants, this makes them an ideal potted house plant. Two seeding dates and five varieties were evaluated.

Seeds were germinated in peatlite mix at 21°C in bedding plant trays and were later transferred to six inch Azalea pots three plugs to each pot. An early February and late April seeding was done. Plugs seeded in February were transplanted April 19 and they started flowering April 28. Flowers lasted for five weeks from first flower. In second crop, plugs were transplanted June 3 and the plant started flowering June 21. The flowers lasted until the end of July. Plants were watered with 10-52-10 at a rate of 1 g/L for two weeks from the time of plug transplant, followed by 20-20-20, 0.75 g/L; $MgSO_4$ 0.5 g/L and 15.5-0-0 at 0.5 g/L.

This fertilizer program maintained excellent leaf and flower colour. Thrips were the major insect problem.

Scientific Publications

M. Mirza, 1991. Production of vegetables and flowers in greenhouses under cold climates, Alberta, Canada. Presented at the Third International Symposium on Cold Region Development, June 16-21, 1991, Edmonton, Alberta, Canada. Published as an extended abstract, ISCORD 1991, p 30

M. Mirza, 1991. Profile of a northern grower. Presented at the Third International Symposium on Cold Region Development, June 16-21, 1991, Edmonton, Alberta, Canada. Published as an extended abstract, ISCORD 1991, p 34

M. Mirza, 1991. Production of greenhouse vegetables in Alberta. Presented at the Alberta Horticultural Congress and Trade Show, October 31 - November 2, 1991, Red Deer, Alberta. Article published in the proceedings

M. Mirza, 1991. Management of greenhouse cucumbers and tomatoes. Presented at the Saskatchewan Greenhouse Growers Association Conference, November 1991, Saskatoon

M. Mirza and M. Younus, 1991. Management of white spruce seedlings for target height and stem caliper. Presented at the 3rd Annual Tree Seedling Course, December 1991, Smoky Lake, Alberta

M. Mirza and M. Younus, 1991. Media porosity and water holding capacity as related to tree seedling production. Presented at the 3rd Annual Tree Seedling Course, December 1991, Smoky Lake, Alberta

Other Publications

Alberta Greenhouse Notes, Volume 14, Nos. 1 - 12, 1991

Horticultural Crops Pathology Research - Kan-Fa Chang, Muhammed Younus and Mohyuddin Mirza

Biological Control of Pythium Root Rot of Cucumber in a Hydroponic System

A strain of *Bacillus polymyxa* antagonistic to *Pythium irregulare* was used to control root rot disease of cucumber in a greenhouse. Cucumber seeds were germinated in 10 x 10 cm rockwool cubes which were then transferred onto rockwool slabs (100 x 25 x 25 cm) when seedlings were at two-leaf stage. The rockwool cubes and the slab areas surrounding the cubes were either untreated as a control or treated as follows: 1. 80 ml of *P. irregulare* (10^3 propagules/ml) of *B. polymyxa* (10^6 cpu/ml) were introduced into the cubes and slabs by a syringe needle; 2. cubes received *B. polymyxa* suspension three days ahead of the application of *P. irregulare*; and 3. reverse the sequence of number 2. Three slabs with two rockwool cubes each and plants were placed in a shallow plastic container (80 x 80 x 10 cm) and supplemented with a drip irrigation system. Each plate represented a treatment. The experiment was arranged in a completely randomized block design with three replicates per treatment. Plants in each treatment were evaluated for the total number of fruit production and the total fresh weight.

Statistical analysis of data showed that there was a significant difference at 1% level (Duncan's Multiple Range Test) between the yields obtained from plants supplied with *B. polymyxa*, when compared to no *pythium* control. The differences between other treatments were not significant at 1% level, although a positive yield trend was evident when *B. polymyxa* was introduced after *Pythium* inoculations of rockwool cubes.

Further studies are in progress to study the relationship between the initial *pythium* densities and the effectiveness of *B. polymyxa*.

An Evaluation of Fungicides on *Pythium* Control in Spinach Grown in a Hydroponic System

Pythium root rot of spinach is the most important disease in recirculating hydroponic systems. The objective of this study was to examine the effectiveness of two fungicides in reducing the biomass of *Pythium* and also study toxicity to spinach plants.

An inorganic nutrient solution was prepared which contained all the essential nutrients for spinach growth along with 5% spinach root extract and 0.1% sucrose. The N:K ratio was maintained around 1:2.

Fifty ml of this nutrient solution was added to baby jars which were then steam sterilized. Truban and Ridomil solutions were prepared in sterile distilled water and added to the above jars to obtain a final concentration of 1, 2, 3, 4, 5, 6, 8 and 10 ppm. Two 8 mm discs of *Pythium* were taken from young cultures and inoculated into the above mentioned solution in the jars.

The jars were kept at room temperature with no shaking. The mycelium was collected after 10 days on a filter paper and fresh weight was determined.

The results indicated that the *Pythium* biomass decreased as the fungicide concentrations increased. At 5 ppm of both Truban and Ridomil the *Pythium* biomass decreased by 88.6% and 83.4% compared to control. At higher concentrations the decrease in biomass was minimal.

Phytotoxicity to spinach plants was tested by growing seven day old plants in the nutrient solution along with 5, 10 and 15 ppm of Truban or Ridomil. Appropriate controls were kept with no fungicides in the solution. The solution was taken from a larger growing module where natural population of *Pythium* was present.

Plants grown in a solution with 5 ppm of Truban showed a healthier root system and 20% better total fresh weight. Plants grown in a solution with 5 ppm of Ridomil showed a 15% better fresh weight when compared to non-fungicide controls.

At 10 and 15 ppm concentrations of both fungicides, plants suffered root damage and this was reflected in a decrease in their fresh weights. When compared to control, the fresh weight was 10 and 50% less at 10 and 15 ppm of Truban and 30 and 65% less in case of Ridomil.

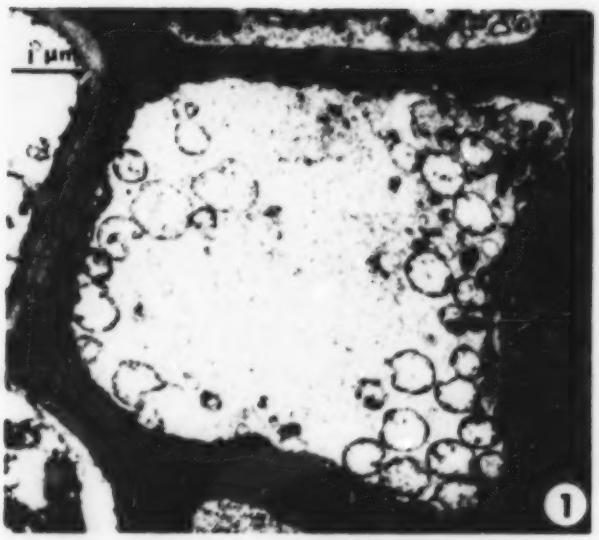
This research was carried out by Wanyu Chen, with assistance from Sun Country Foods, Spruce Grove.

Etiology of Yellowing and Phyllody of Winged Everlasting

Winged Everlasting (*Ammobium alatum* R. Br.) is a hardy perennial herbaceous plant but grown as an annual in Alberta and marketed as a dried flower. In the summer of 1991, in fields of central and southern Alberta, as many as 42% of the plants were infected by a disease with unknown etiology. The diseased plants showed symptoms of yellowing and reddening of the basal leaves and winged stems, stunting, and flower phyllody. Sections from tissues of infected stems which were fixed and stained with DAPI and examined with UV fluorescent microscope showed that strong fluorescent areas are present in the phloem. Examination of ultrathin sections obtained from diseased leaf vein revealed that mycoplasma-like organisms (MLOs) were found in the sieve tube cells of phloem. These pleomorphic MLOs, ranging from 0.12-0.73 μm averaging of 0.40 μm in diameter, were mostly round in shape. This is the first report of MLOs associated disease of *A. alatum*.

This study took place in co-operation with S.F. Hwang, Alberta Environmental Centre, Vegreville.

Figure 1. MLO bodies in a sieve tube if a leaf mid-rib obtained from a phylloid plant (x 15,000).



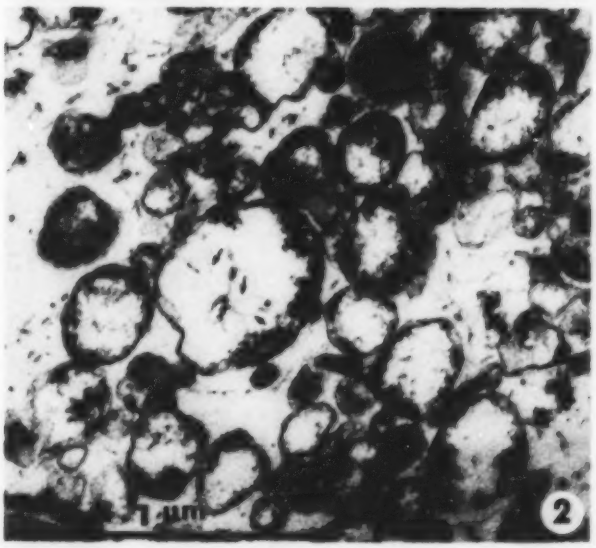


Figure 2. Enlarged view of MLOs showing DNA fibrils (arrows) (x 60,000).

Chemical Control of Juniper-Saskatoon Rust on Saskatoon

Saskatoon Rust (*Gymnosporangium nelsonii* Arth.) often occurs in the early spring in orchards where the leaves, shoots and berries intercept the basidiospores produced by the telial horn on juniper galls (Figures 3 and 4). The control test was conducted at a six year old saskatoon orchard site near Drumheller with tree spacing of 0.9 x 3.5 m. The plot was replicated twice, five trees per plot, in a block design. Fungicides were sprayed to runoff using a backpack hand sprayer at 0.8 kg/cm^2. The fungicides and rates (product per 20 L) used were Tilt (10 g, 20 g), Bayleton (10 g, 20 g), Captan (10 g, 20 g), Benlate (10 g, 20 g), and Manzate (28 g, 56 g). The spraying times were: May 21, May 28 and June 4, which was when natural infection occurred but the fungus had not sporulated in the leaves. The study indicated that a single application of Tilt and Bayleton can effectively control the rust. Three applications of Benlate, Captan, and Manzate will not suppress the formation of aeciospores on leaves of saskatoon.

Figure 3. Saskatoon berries infected with rust.

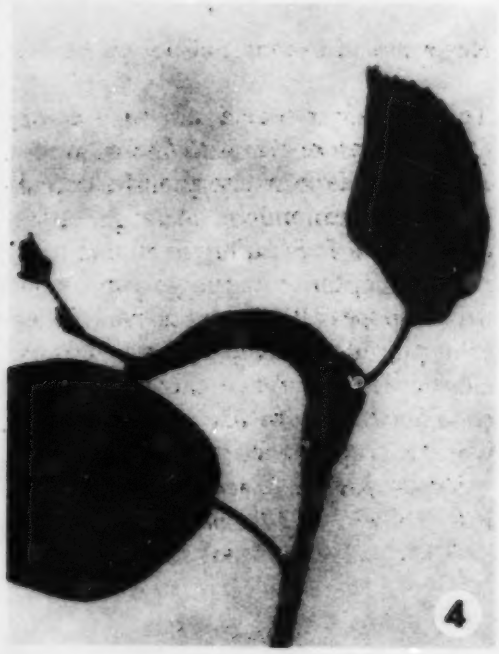


Figure 4. A distorted and swollen symptom of saskatoon shoot caused by the rust infection.

Symptomatology and Occurrence of Mycoplasma-like Organisms Associated Disease of Statice in Alberta

Statice (*Limonium sinuatum* (L.) Mill), a small-acreage flower crop in Alberta, is often used as a cut flower or in a dry bouquet. Surveys of mycoplasma-like organisms (MLOs) of statice conducted in fields at Warwick and Bon Accord in August 1991 revealed that the disease incidence and severity and flower loss varied with cultivars and locations. On average, 35% of plants were infected and 22% of the flowers were lost. The first symptom of leaf reddening appears on the infected plants of statice and may extend to the flowering stem and eventually the whole plant becomes red. Young plants infected at the early stage may show severe stunting and fail to produce flower stem and panicle. Stems of the infected plant become pale green and thinner than normal, forming little or no wings. The spikelets may grow repeatedly and produce a bunching or witches'-broom symptom. Sometimes phyllody is observed in the influorescence. Occasionally, extra shoots may emerge from the junction area of the branching stem. MLOs were found in phloem cells of ultrathin sections of the leaf vein, stem, pedicel and flower parts. This is the first report of MLOs disease of statice in Alberta.

This study was conducted in co-operation with S.F. Hwang, Alberta Environmental Centre, Vegreville.

Response of Poplar Species to Leaf Rust Under Natural and Controlled Conditions

Twenty-four species and hybrids of *Populus* spp. were tested for their resistance to leaf rust (*Melampsora occidentalis* Jacks.) under field and greenhouse conditions. In the field of the Alberta Tree Nursery and Horticulture Centre, 18 plants of each species of poplar were visually examined in August/September 1991. Among them, only *P. deltoides, P. tremuloides, P. balsamifera,* and *P. trichocarpa* were susceptible. For artificial screening test, rooted poplar cuttings grown in pots containing soilless mix, were inoculated with urediospores (10^4 spores/ml) and incubated in a moist chamber for 24 hours. Cuttings were then placed on the greenhouse bench at 20°C for the observation of disease development. Besides the above mentioned species, *P. x canadensis* 'Eugenei', *P. x* 'Griffin', *P. x canadensis* 'Serotina', *P. x* 'Skinner', *P. tristis, P. x* '78101', *P. x* '38P38' and *P. x* 'Brooks #6' were susceptible to the rust with a latent period of about seven days. *Populus x* 'Assiniboyne', *P. koreana, P. x* '8601', *P. x canescens* 'Tower', *P. x berolinensis, P. x* 'Dunlop', *P. x* 'D-709', *P. alba nivea, P. nigra* 'Italica', *P. x* 'Northwest', *P. tremula* 'Erecta' and *P. x* 'Walker' were resistant to leaf rust.

Search for Alternate Host of *Melampsora Occidentalis* Other than Trees

Heavily infected Northern Willow Herb (*Epilobium ciliatum* Raf.) and aspen seedlings with rust (*Melampsora occidentalis* Jacks.) have been found together in a commercial greenhouse in August 1991 in Bowden, Alberta. Aecial stage of the rust formed on both sides of leaves of *E. ciliatum* with the majority on the abaxial side of the basal leaves. The orange colour aeciospores, size ranged from 17.5-22.5 x 12.5-20.0 μm, are globular or elliptic with verrucose walls. The pathogenicity of the aeciospores on aspen and poplar trees is currently under study.

Research Publications

K.F. Chang, M. Mirza and S.F. Hwang, 1991. Etiology and the occurrence of root rot disease complex of alstroemeria. Can. Jr. Pl. Pathology, Vol 13 (3), 1991 (Abstract)

K.F. Chang, M. Younus and M. Mirza, 1991. The comparative pathogenicity and biological control of *Pythium spp* in tomato and cucumber. Can. Jr. Pl. Pathology Vol. 13 (3), 1991, pp 273 (Abstract)

Micropropagation - K. Pruski

In 1991 the tissue culture laboratory continued work on micropropagation, providing service and support to the industry. Saskatoon plant production was lower than in previous years, 2000 plants were produced for production and research purposes. About 200 plants were sent to the Agricultural University in Warsaw, Poland along with some chokecherry and pincherry plants. Another 200 plants were sent to Idaho. The University of Saskatchewan received about 1000 saskatoon plants and ordered 200 more for spring 1992. New cultures of all cultivars have successfully been established for 1992.

The sour cherry cultivar from Poland, 'Lutowka', was evaluated for its hardiness in Alberta. After the second winter existing cherry orchards (planted in 1989) at Brooks, Edmonton, Beaverlodge and Fort Assiniboine experienced severe frost injuries probably due to excessive growth during the previous growing season. Some of the plants had about one metre of new growth and were still actively growing in October 1990. In 1991 the fertilizer program for these orchards was considerably reduced and, in effect, the average growth was only 25-40 cm. All plants were dormant by mid-September. The winter of 1991/92 will be critical for these trees since their crowns will be above snow cover. The laboratory produced another 200 trees for research purposes. There still is a strong demand for 'Lutowka' cherry among Alberta, Saskatchewan and Manitoba growers.

The laboratory continued propagating two superior selections of pincherry, 'Jumping Pound' (Alberta Special Crops and Horticultural Research Center, Brooks) and 'Mary Liss' (Native Fruit Nurseries Ltd., Tofield, Alberta). About 200 plants were produced and new cultures for 1991 were successfully initiated. Three lines of Mongolian cherry cultures were initiated. Explants were taken from mature plants grown at the site of the Alberta Tree Nursery and Horticulture Centre. The selections have large tasty fruits and could be used for food processing.

The micropropagation project on conifers continued. Optimal conditions for initiation of cultures from dormant buds were determined. Multiplication and rooting stages are still under investigation.

A total of 90,000 potato plantlets were produced in 1991 for greenhouse planting. New cultures required for 1992 have been prepared.

Table 1 summarizes plant material produced in the laboratory during 1991.

Table 1. Plant material produced through tissue culture in 1990.

Plant	Total number of plants
Potato (all cultivars)	90,000
Pincherry 'Mary Liss', 'Jumping Pound' (100+100)	200
Chokecherry 'Garrington'	200
Sour Cherry 'Lutowka' Poland	200
Saskatoon (all cultivars)	2,000
Total	92,600

Research - K. Pruski, T. Lewis, T. Pheh and M. Mirza

Several micropropagation research projects were initiated and conducted at the laboratory in 1991. Laboratory continued with the co-operation of the Plant Molecular Genetics Centre (Dr. Szalay) section of Plant Science Department, University of Alberta. More emphasis was placed on genetic transformation of potato. Research work is summarized in the following abstracts:

Micropropagation of Scots Pine, White, Norway and Colorado Blue Spruce

Micropropagation of spruce and pine was investigated. Vegetative, terminal buds and interfoliage fascicle (from outdoor grown plants) were used as explants. Following sterilization in alcohol and bleach, explants were placed on nutrient media. Four different culture media were tested: Quirin & LePoivre (LP), Schenk & Hildebrandt (SH), Gina Mohammed Dunstan (GMD) and von Arnold & Eriksson (AE). Explants were incubated for seven weeks in a growth room at 24°C with 16 hours photoperiod at 3000 lux. Norway spruce cultures on all media tested turned brown after the incubation period. White spruce cultures produced pea size buds but failed to elongate into shoots - AE medium was found most suitable for their growth. Colorado blue spruce explants produced large amount of callus but no shoot regeneration was observed. The callus is presently being subjected to various hormonal treatments in order to induce organogenesis. Addition of Sorbitol to the culture media seems to be essential since on media without this compound, growth of cultures was very slow and browning occurred very quickly. The pine cultures were the most difficult to initiate (high contamination rate was observed since explants were very difficult to sterilize). The GMD and SH media were most suitable for culture. Cultures failed, however, to produce shoots and after eight weeks of incubation became brown.

The experiments are being continued since developing the micropropagation system for spruce and pine (from vegetative buds) might be very useful in propagating valuable specimens of these species.

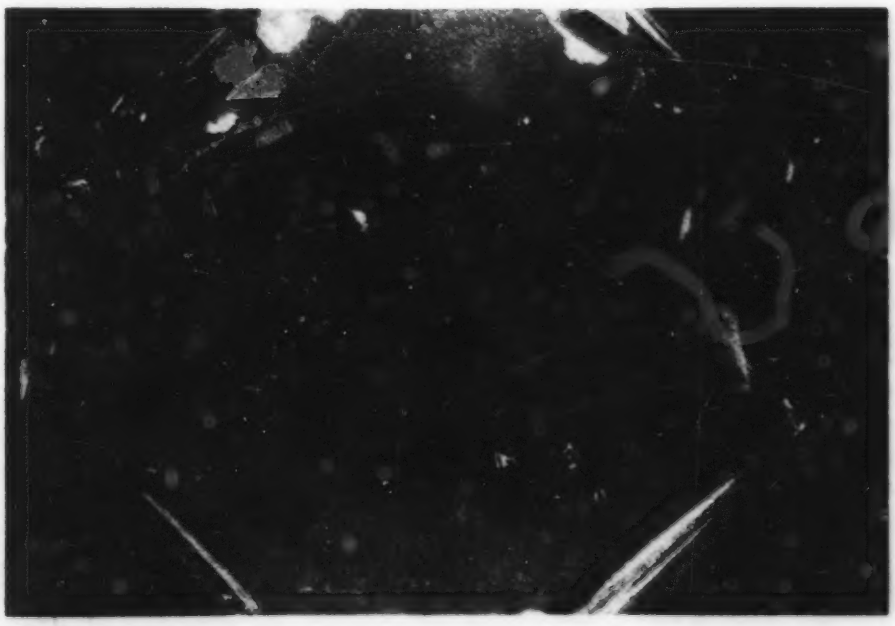
Micropropagation of Sour Cherry

Micropropagation of Sour Cherry (*Prunus cerasus*) cvs 'North Star', 'Lutowka' (Shattenmorelle), 'Dwarfrich' and 'Wczesna z Prin' was investigated.

Dormant buds from field grown plants were used as explants to initiate cultures. MS and WPM media were used for culturing. Indole-3-butyric acid (IBA) at 0.2 mg/L and benzyladenine (BA) at 2 mg/L were found optimal for initial growth of cultures.

Cultures grew and proliferated very well on both media. Addition of BA at 1-1.5 mg/L was optimal for proliferation of all cultivars tested. Multiplication ratio of 1:5 to 1:7 in a three week incubation period (Figure 1) was observed with cvs 'North Star', 'Lutowka' and 'Wczesna z Prin'. Cultivar 'Dwarfrich' was difficult to proliferate giving the ratio of 1:2.5 in the three week incubation period. Rooting of cultures was performed *ex vitro* on the bottom heated greenhouse bench under intermittent mist. Plantlets were rooted in roottrainers filled with soilless mix. Indole-3-acetic acid (IAA) at 2 mg/L was applied as a spray once a day during the first week of the rooting period. There were 60-85% rooting observed after the five week rooting period.

Figure 1. Cultures of sour cherrry 'Lutowka' on multiplication medium.



In Vitro Propagation of Chokecherry and Pincherry

Micropropagation of selections 'Garrington' and 'Goertz' of chokecherry (*Prunus virginiana*) and selections 'Mary Liss' and 'Jumping Pound' of pincherry (*P. pennsylvanica*) was undertaken in order to quickly increase the number of plants.

Explants were taken from either dormant buds from the field grown plants or shoot tips from greenhouse grown plants. Cultures were initiated and multiplied on WPM and MS media with 0.1 mg/L of IBA and 1.5 mg/L of BAP. Both types of explants and both types of media were equally successful in initiation and proliferation of cultures. It was observed, however, that the selections of chokecherry grew much better when concentration of salts in both media was reduced by 40%. The BAP concentration of 1 mg/L was found optimal for shoot proliferation (Figure 2). Before rooting cultures were placed on hormone-free medium for three weeks for elongation. Rooting was performed in the greenhouse on the bottom heated bench under intermittent mist. Plantlets were rooted in roottrainers filled with deciduous soilless mix. IAA+NAA (2 mg/L and 0.5 mg/L, respectively) was applied to plants as a spray for the first two weeks of the rooting period. Rooting percentage varied from 67% to 89% with pincherry being the highest. Rooting was complete within five weeks.

Figure 2. A culture of pincherry 'Mary Liss' ready for division. At the bottom of the culture excessive callus formation.

In Vitro Tuberisation of Potato cvs Sangre and Russet Burbank

Potato microtuber production was investigated. Two cultivars were used in this experiment, Russet Burbank and Sangre.

Single nodal cuttings from *in vitro* grown plantlets were used to initiate cultures. Twenty cuttings were placed in 250 ml flasks filled with 30 ml of liquid MS medium supplemented with: 1) 2.5 mg/L kinetin (K) + 60 g/L sucrose and 2) 2.5 mg/L kinetin + 500 mg/L CCC + 60 g/L sucrose. Media were changed for fresh every two weeks during the 12 week growing period. Within two weeks stem thickening and callus formation was observed in both cultivars on media with K and CCC. After 10 weeks of culturing definite tuber formation was observed in both cultivars on media with K and CCC. On media without CCC microtubers were bigger but fewer tubers were formed. Produced microtubers will be subjected to dormancy evaluation (dormancy length and uniformity of sprouting). The study will be done in the greenhouse in cell packs. Gibberellic acid, GA_3 at 100 ppm will be used for breaking dormancy. The project is being done in co-operation with Dr. Nowak from the Nova Scotia Agricultural College in Truro, Nova Scotia.

Use of Brassinosteroids in Rooting of Saskatoons *In Vitro*

A brassinosteroid, 24-epi-Brassinolide (Grow Tec Ltd. Nisku, Alberta) was tested in the saskatoon rooting medium in order to improve rooting of plantlets. The experiment consisted of five treatments: 1) Control 1/2 MS salts 2) 1/2 MS + 0.5 mg/L IBA (as a positive control) 3) 1/2 MS + 0.05 mg/L of 24-epi +/- O.5 mg/L IBA 4) 1/2 MS + 0.1 mg/L of 24-epi +/- 0.5 mg/L IBA and 5) 1/2 MS + 5 mg/L of 24-epi +/- 0.5 mg/L IBA. Shoots of cv 'Pembina' were placed individually to test tubes and incubated for four weeks in the growth room at 24°C with 16 hour photoperiod at 3000 lux. The highest (5 mg/L) concentration of 24-epi was far too high and all plantlets became brown within 10 days. After four weeks the control plantlets did not produce any roots. Plantlets in positive control were rooted in 70% showing typical heavy callus formation. Plantlets on medium with 24-epi at 0.05 and 0.1 mg/L produced few roots but no callus. The best rooting occurred on medium with 0.1 mg/L of 24-epi and 0.5 mg/L IBA (85%). No callus formation was observed but roots were tiny and slightly deformed and twisted. The concentrations of 0.1, 0.2, 0.3 mg/L of 24-epi are now under investigation. It seems that the mode of action of 24-epi is similar to that for gibberellins except 24-epi does not suppress root initiation while gibberellins do.

Propagation of Apple Rootstock and Selected Dwarf Cultivars of Fruiting and Ornamental Apple *In Vitro*

In vitro techniques were used in propagation of apple rootstocks M-9 and MM 3426, and several dwarf cultivars of apple: 'Thunderchild', 'Royalty', 'Norland', 'Ottawa III' and six local selections. Dormant buds were used as explants. Following sterilization in 0.5% bleach, explants were placed on MS medium supplemented with BAP at 1 mg/L and IBA 0.1 mg/L. For proliferation stage the MS medium with 1 mg/L of BAP was used. Multiplication ratio 1:2 to 1:7 was observed within a three week incubation period at 24°C with 16 hour photoperiod at 3000 lux. M-9 rootstock failed to proliferate. The local selection - CC4 and 'Thunderchild' were proliferating rapidly, ratio 1:7. Good proliferation was observed with 'Royalty' and six local selections, as well as with MM 3426. Rooting was performed *ex vitro* on the greenhouse bench with bottom heat (25°C) under intermittent mist. During the first two weeks of the rooting period, plants were sprayed with IAA at 2 mg/L. The rooting percentage varied from 50 to 85% depending on cultivar, with the local selection - FC1 being the highest 85%. Rooting was complete after five weeks.

Scientific Publications

Books:

Pruski K., Mohyuddin M., Grainger G. 1991. Saskatoon (*Amelanchier alnifolia* Nutt.). In: Biotechnology in Agriculture and Forestry. Ed. YPS.Bajaj. Springer-Verlag, Berlin. Vol.16 Trees III. pp.163-179

Abstracts:

Pruski K., Mirza M., Grainger G. 1991. Role of micropropagation in the development of horticulturally important crops in cold regions. Third International Symposium on Cold Region Development, Edmonton, Canada. Abstract, p.39

Pruski K., Pietucha S., Mirza M. 1991. Autotrophic micropropagation of potato (*Solanum tuberosum*) 1991 World Congress on Cell and Tissue Culture, Anaheim, USA. In Vitro 27(3): Abstract #35 p.44

NURSERY CROP DEVELOPMENT SECTION

Introduction - Brendan Casement

The primary objective of the Nursery Crop Development Section at the Alberta Tree Nursery and Horticulture Centre is the production and distribution of trees and shrubs for shelterbelts, which conforms to the strategy of the Alberta Department of Agriculture, Production and Marketing Sector, Plant Industry Division and our Branch. Although there is a production aim of five million plants, the production is geared to demand. Unfortunately, the late May frost in 1987 killed most of the cutting beds of northwest, brooks and griffin poplars and it has taken up to the summer of 1991 to obtain sufficient plants to regain the necessary cutting production. The demand has continued to increase by about 30% each year since the introduction of the fee for service in 1987.

The Canada/Alberta Soil Conservation Initiative provided funds for the production of some of the stock, and farmers were able to obtain free trees and shrubs for field windbreaks from this initiative to protect their soil or crops from wind damage. This accounted for 60% of the 1991 distribution.

We were fortunate to have two Canada/Alberta Soil Conservation Initiative contracts in 1991. One, with Richard Escott, to survey the shelterbelts in Alberta and develop recommendations to incorporate into the draft publication "Shelterbelt Varieties for Alberta". The second, with Lamoine Maryniak and Gloria Hooke, visited farms which had received shelterbelt plants in 1985, 1988 and 1991. These years were chosen for study as the plants received in 1985 were free, while 1988 was the first year of charging and in 1991 about one third of the plants were purchased while two thirds were for field windbreaks and were free to the farmer under the Canada/Alberta Soil Conservation Initiative. There did not appear to be any difference in the survival of the plants between the three years, only in the volume requested. They concluded that farmers who look after the plants properly will do so, whether there is a charge or not.

Extension

In 1991 there were 106 registrants for the annual basic pruning course at the Alberta Tree Nursery and Horticulture Centre in three sessions. This was the twentieth year that it had been offered and certificates, suitable for framing, were given to the 96 successful participants. This course has increased in popularity over the years, and in 1991 all three sessions were filled, and there was a waiting list for the next year.

Ten lectures or courses on shelterbelts were given from Taber to Athabasca and eight shelterbelts were visited from Beiseker to Foremost to check survival and development. Shelterbelts, given minimal care, established and grew very well in 1991, at least doubling

their height. Only around Blackie was there problems with grasshoppers defoliating caragana and green ash. Ten other talks were presented on such topics as 'Budding and Grafting' and 'Selecting Trees and Shrubs for Calgary Gardens'.

Shelterbelt Production - Brian Breneman, Rulie Bok, Vera Fialkowski, Pat Elliott and Henry Brown.

The growing season of 1991 was very good for establishing most nursery crops. The damp weather during May and June provided the best conditions for the germination and emergence of plants without being too wet to prevent field work on the lighter soils. Unfortunately, the griffin poplar and cottonwood cuttings had been planted in heavy soil and heavy losses occurred. Good crop growth and minimal weed emergence took place in July and August with the warm, dry weather, but the continued dry weather into fall was detrimental to crop production and harvesting operations. Irrigation was necessary to soften the soil for harvesting, then the snowfall and cold weather in mid-October shut down the harvest with 14% of the deciduous material left.

During the winter 953,000 hardwood cuttings of poplars and willows were prepared. These were field planted immediately after shipping, which was completed in eight working days by May 31.

The assembly of the orders took ten days and the main shipping occurred between April 29 and May 22. Additional shipping lasted until June 5 to accommodate late GST payments.

Between August 5 and September 4, 1991, 562,000 conifers were transplanted and by the end of September, even with the dry conditions, extensive new root development had taken place. During the summer 12,100 linear metres were sown and 9,700 metres were fall seeded to 27 species of shelterbelt material. Caragana accounted for 48% of the area sown.

Harvesting commenced on September 16 on dry soil, irrigation was applied and improved the soil conditions for lifting. The snowfall on October 16 would have aided lifting if the cold weather had not followed, this has left additional work for the spring of 1992. A total of 1.18 million deciduous plants were graded out and placed in storage from the fall harvest.

Distribution Summary - 1991

1) Shelterbelt Program - actual number of plants.

	No. of Appl.*	Tall Decid.	Small Decid.	Hedge	Evergreen	Cons. Bundle	Total
Lethbridge	723	37,725	10,300	266,675	18,900	1,840	335,440
Airdrie	701	55,700	9,600	310,675	27,100	2,340	405,415
Red Deer	587	60,425	5,175	212,850	29,960	1,860	310,270
Vermilion	699	86,050	7,700	69,625	41,020	2,280	206,675
Barrhead	423	51,475	6,800	29,875	31,400	1,880	121,430
Peace River	468	34,500	7,150	51,875	21,660	2,460	117,645
Total	3,601	325,875	46,725	941,575	170,040	12,660	1,496,875

(904,830 plants were distributed to 501 farmers through the Canada/Alberta Soil Conservation Initiative)

* Number of applications include new and replacement orders - not backorders.

2) Miscellaneous

Demonstration Shelterbelts	44,897
Fish and Wildlife Plantings	68,094
4-H Bundles	1,000
Arbor Day Seedlings	64,099
Provincial Parks	5,959
Forever-a-Tree	400
Total	185,449

3) Total plants distributed in 1991 = 1,682,324

Container Production - Cecilia McIsaac and Sophie Eckberg

There was a 10% loss of seedlings from the 1.4 million that were overwintered in the lathhouses in 1990/91. The Siberian larch, Scots and lodgepole pine were mainly affected. During 1991, 1,139,400 seedlings were produced in the greenhouses.

Of the 64,099 seedlings shipped for Arbor Day there were 37,269 Colorado spruce, 22,030 lodgepole pine and 4,800 white spruce. TransAlta Utilities distributed most of the pine to the rural schools in their distribution area.

There was an overwintering loss of 14% of the potted native species during the winter of 1990/91. The common juniper and lodgepole pine were the species most affected. Of the 10,600 plants distributed in 1991, only 1% were in the five gallon pots, 2.6% were in 'Grow Bags', 39% in two gallon pots and the rest in one gallon pots.

Seed Collection - Simone Dalpé, Nancy Moroz and Crystal Moore

Although there was good seed production on most species in 1991 some of the cherries were not picked because of poor quality. Scots pine had been left until last but cold weather stopped the harvest. The seed was empty on the Bugnet pine at Sangudo, and the contracts for caragana seed were not filled, leaving us with insufficient seed for 1992. The 4,440 kg of fruit and cones that were collected yielded 453 kg of cleaned seed.

We were grateful for the caragana seed (45.36 kg) from the Shelterbelt Centre, Indian Head and 35.04 kg was purchased from four Hutterite Colonies. The Pine Ridge Forest Nursery at Smoky Lake donated 10 kg of Jack pine seed, 5 gm of curly birch seed was received from Helsinki and 764 gm of white cedar was purchased from Lawyers Nursery in Plains, Montana. Seventeen kg of seed were sold, and 52.9 kg were donated to various causes, including 45.5 kg of green ash to the Shelterbelt Centre in exchange for the caragana seed.

Chemicals - Roy Marquardt.

Over 600 chemical treatments were made in 1991, 425 to shelterbelts, production and non-production fields, vegetable plots and lawns, and 184 treatments to greenhouses, lathhouses and buildings. Some chemical damage occurred on shelterbelts as there was heavy weed growth, including Canada thistle, quackgrass and toadflax, that had to be controlled.

A shield was fabricated for a sprayer to protect the poplar and willow cutting beds from chemical spray. This is one of the areas that is being emphasized in weed control as there is need to increase production of cuttings.

Commodity Review

Alberta has a young but progressive and developing Nursery industry with some nurserymen having broken into the export market by supplying stock to Montana and Alaska. It is difficult to estimate the value of this, and associated industries, as there is no Board or Commission that controls production or does the marketing for the industry. Nursery stock is valued at $50,000 to $100,000 per acre ($1,000,000 per acre of container stock of which there is about 15 acres). Estimated value of nursery products sold in Alberta from the 'Human Resource Study of the Canadian Horticulture Industry - Alberta Working Party Interim Report' dated February 3, 1992 was $10,556,000 for 1990. They estimated that

there are 5,143 acres on 291 operations involved in the production of trees and shrubs. This is an unrealistically low value; with a minimum turnover every ten years the retail value of field grown plant material is in excess of $25,000,000 and container stock is turned over in two years giving a value of $7,500,000.

Most of the nursery growers in Alberta had a positive year in 1991, reporting that sales were somewhat higher than in 1990, and the area under both field and container growing increased over the previous year.

Research

Regional Woody Plant Test Program - G. Grainger, B. Casement, M. Robertson, T. Pheh, N. Seymour and cooperating Nurseries of the Landscape Alberta Nursery Trades Association.

This cooperative trial between Alberta Agriculture and the Landscape Alberta Nursery Trades Association resulted from a resolution presented to the Environmental Horticulture Advisory Committee in 1981. The purpose of which was to a) improve the variety and number of shade and ornamental plants available to Albertans, and b) to improve the reliability of recommendations by all extension people in Alberta. The initial test plants were planted in 1983 at three sites - The Alberta Tree Nursery and Horticulture Centre, Edmonton, the then Alberta Horticultural Research Center, Brooks and Foothills Nursery in Calgary. In 1984 four other sites were planted - Willow Valley Nurseries, Grande Prairie; Lacombe Nurseries, Lacombe; Alberta Nurseries and Seeds, Bowden; and Coaldale Nurseries, Coaldale. Records are taken annually of growth and winter injury, and after six growing seasons recommendations are made. At present there are 139 trees and shrubs in the project.

Nutrient Study of Woody Plants - G. Grainger, B. Casement and T. Pheh

At present our fertilizer recommendations are based on suggestions from elsewhere, and not on actual studies in Alberta. Therefore, this long term trial was initiated in 1986 to correlate growth of woody plants with sixteen different combinations of nitrogen, phosphorus and potassium. Records of growth, as well as soil and tissue analysis are compiled annually from the six tree and eight shrub taxa to determine the most suitable nutrient levels under our conditions.

Woody Plant Test Project - B. Casement and T. Pheh

1. Prairie Regional Trials for Woody Ornamentals. Cooperator - C. Davidson, Agriculture Canada Research Station, Morden, Manitoba. The Prairie Regional Trial for Woody Ornamentals was initiated in 1958 by the Western Canadian Society for Horticulture after a very severe cold spell the previous winter had killed many ornamental and fruit trees. Ten universities and research stations on the prairies cooperated in an effort to increase both the range of plant material available and the reliability of recommendations. The Woody Plant Research Scientist at the Agriculture Canada Research Station at Morden, Manitoba acts as coordinator, introduces and propagates the plants and prepares summary reports every three years. Since 1958 there have been some changes in the test sites. Most of the Federal Research Stations have had to drop out and, after almost 30 years of having a test site the University of Alberta, the Horticulture Division was forced to terminate the trial. In 1988 the Alberta Tree Nursery and Horticulture Centre was able to provide the required land and staff, and became a test site to replace the University in the Edmonton area. Annually, after six growing seasons the results will be forwarded to the Research Scientist at Morden for tabulation.

Woody Plant Test Project - B. Casement and T. Pheh

2. Cooperative Hardiness Trial. Cooperators - local nurserymen and private individuals. Plants are donated to, or acquired by, the Alberta Tree Nursery and Horticulture Centre for evaluation. In 1988, 100 hardwood cuttings of the heavily advertised Australian Willow were purchased and planted. The rooting percentage of the cuttings was high, and the resultant plants grew to two metres tall the first year, 2.4 metres tall in 1989 and three metres tall in 1990 and 1991; but from the ground each year as all top growth was killed.

All-America Selections Annual Flower Trial - B. Casement, T. Pheh and the All-America Selections Committee.

Seeds of new, unnamed annual flower selections are received from the committee for growing in our conditions. Ten metre long rows are planted of each selection with between one and three comparison cultivars. The comparison cultivars are the best available of the same type with similar flower characteristics and colour. The selections are compared (judged) at least three times during the summer, and the committee is provided with a written evaluation at the end of the season. The results are collated by an independent auditing company, and superior selections receive international promotion. The Alberta Tree Nursery and Horticulture Centre is one of five test sites in Canada and 30 in North America. In 1991 there were 42 cultivars of which 14 were new seedlings. One or two of the best of these seedlings may be released as 'All-America winners' in two to three years time.

Shelterbelt Evaluation - B. Casement and S. Dalpé

Crop yields on five sites in central Alberta that have well maintained shelterbelts are being monitored. These sites, at Drumheller, Altario, Vermilion and St. Paul, have good older shelterbelts and the farmers allow us to take snow depth measurements, soil samples to determine the soil moisture content and crop yields at various distances from the shelterbelt. From this data, effects of shelterbelts are being determined under Alberta conditions.

Berry Crop Trials - L. Hausher and S. Dalpé

This trial is directed by the Fruit Crop Specialist at Brooks, and the results are submitted to him. There were no major problems in 1991 in the strawberries and raspberries although the elm root aphid that has attacked the saskatoons causes major losses. A minor copper deficiency occurred in the strawberries but was easily corrected. The Tree Nursery also acts as a distribution point for strawberries purchased by the growers from California and two-thirds of the Alberta total (468 cases) were distributed.

Maple and Birch Pruning Trial - T. Pheh

A small pruning trial was carried out in the spring of 1991 to determine the earliest spring pruning date for birch and Manitoba maple to minimize "bleeding". Mature stands of white birch (*Betula papyrifera*) and Manitoba maple (*Acer negundo*) were selected for the trial. Low, hanging branches were pruned to between 20 and 30 cm from the trunks and a plastic bag was attached to each stub to collect the sap expressed. The birch were pruned on eight different dates while the maple were only pruned five times. The wounds on trees pruned while dormant, on the 11th of March, remained dry as long as the temperature was below freezing. As soon as the temperature was above freezing, sap began to flow, starting as guttation that just wetted the cut surfaces but as temperature climbed, drippings were observed. In birch, the heaviest flow occurred when the terminal buds were near breaking while in the maple it was when the terminal buds were swelling. From this trial we can suggest that white birch be pruned as soon as the first leaves on the terminal buds are fully formed, while Manitoba maple can be pruned slightly earlier, that is when the plants are leafing out. Bleeding is not likely to cause too much stress on the carbohydrate reserves of a birch or maple, as the carbohydrate content of the sap was low.

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

1991 Weather Summary

Month	Max. Mean°C	Min. Mean°C	Mean°C	High°C	Low°C	Rain mm	Snow cm
January	-6.8	-16.3	-11.5	8.0	-40.0	0	4.8
February	2.7	-5.2	-1.2	9.0	-18.0	7.6	20.7
March	0.9	-12.0	-5.5	15.0	-29.0	6.0	23.7
April	13.1	-0.4	6.4	23.0	-5.0	32.0	0
May	17.8	4.1	10.9	26.5	-7.0	90.3	0
June	19.8	8.6	14.2	25.5	3.5	156.3	0
July	24.5	10.5	17.5	31.0	6.0	16.8	0
August	25.6	11.6	18.6	33.5	7.0	65.8	0
September	18.1	5.1	11.6	25.0	-5.0	16.9	0
October	6.3	-4.0	1.1	25.0	-22.5	0.4	36.6
November	-0.2	-11.3	-5.8	9.0	-27.5	0	6.2
December	-3.8	-13.8	-8.8	6.5	-29.0	0	19.9

Growing season (between killing frosts) May 4 to September 17 - 135 days.

FARM SERVICES SECTION

Farm Report - Al Faulkner

Farm Services supplies field irrigation, cultivation, mechanical seeding, vehicle and equipment maintenance, general maintenance and repairs, and many other services as required.

In the 1991 season, 13 seasonal staff were hired to help meet our responsibilities. We used 954.88 work days from a possible 1345 work days. This is 229.65 work days less than in 1990.

Cultivation

Field and row crop cultivation was done as required, keeping to the "zero till" directive.

Organic Waste

A very large compost pile has been in use for the past 10 years with manure from Edmonton Public Stockyards and our own organic wastes being incorporated. We in turn use the composted material to improve our soil structure texture.

Irrigation

We irrigated 664 hours and applied 24,303,240 litres of water.

Rodent Control

There were another five porcupines removed before they could cause much damage. Every season the beavers move in and start cutting the trees along the creek, this season we had to remove six.